Thumb Run, Carter Run, Great Run, and Deep Run Bacteria Total Maximum Daily Load Implementation Plan

Submitted to:
Stakeholders of Thumb, Carter, Great, and Deep Run Watersheds

On Behalf of:
The Commonwealth of Virginia
Department of Conservation and Recreation and
Department of Environmental Quality

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INTRODUCTION

TMDL is an acronym for Total Maximum Daily Load, which is the maximum amount of pollutant that a water body can assimilate without surpassing the state water quality standard. If the water body surpasses the water quality standard 10.5% of the time during an assessment period, the water body is placed on the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. Deep Run was initially placed on the 1996 Section 303(d) list based on violations of the fecal coliform bacteria water quality standard. Thumb Run, Carter Run, and Great Run were initially included on the 1998 Section 303(d) list because of violations of the fecal coliform bacteria water quality standard. After this listing, bacteria TMDL studies were comprised for each impairment. After the TMDL studies are complete, Virginia's 1997 Water Quality Monitoring, Information and Restoration Act (WQMIRA) states in section 62.1-44.19:7 that the "Board shall develop and implement a plan to achieve fully supporting status for impaired waters". To comply with this state requirement, a two-staged TMDL implementation plan (IP) was formulated to reduce bacteria levels to attain water quality standards enabling delisting of streams from the Section 303(d) List of Impaired Waters (Stage I) and attainment of TMDL source load allocations required under WQMIRA and by USEPA for eligibility to receive Section 319 grant funds to fund implementation (Stage II). Successful completion and local support of the implementation plan will enable restoration of the impaired waters while enhancing the value of this important resource for the Commonwealth. Opportunities for Fauquier County, Stafford County, local agencies, and watershed residents to obtain monetary assistance will improve with an approved implementation plan.

Key components of the implementation plan are discussed in the following sections:

- Review of TMDL Development Studies,
- Public Participation,
- Implementation Actions,
- Measurable Goals and Milestones, and
- Potential Funding Sources.

Microorganisms are ever present in terrestrial and aquatic ecosystems. Most types are beneficial, however, a small subset of microorganisms is harmful. If taken into the body they can cause sickness or even death. As a group, these disease-causing microorganisms are known as pathogens. Pathogens are easily carried by storm water runoff or other discharges into natural waterbodies due to their small size. Once in the waterbody, pathogens can infect humans through contaminated fish and shellfish, skin contact, or ingestion of water. The current designated use for these impairments is full contact recreation, which includes swimming. Excessive amounts of fecal bacteria in surface water used for recreation have been known to indicate an increased risk of pathogen-induced illness to humans (USEPA, 2001). Infections due to pathogen-contaminated recreational waters include gastrointestinal, respiratory, eye, ear, nose, throat, and skin diseases (USEPA, 1986). According to the Centers for Disease Control and Prevention, known pathogens account for an estimated 14 million illnesses, 60,000 hospitalizations, and 1,800 deaths per year in the United States (Mead, 2006). As stakeholders, we must assess the risk we are willing to accept and then implement measures to safeguard the

public from these risks. Water quality standards are society's implementation of legislative measures resulting from an assessment of the acceptable risks.

This booklet is an abbreviated version of the full plan, which can be obtained by contacting the Virginia Department of Conservation and Recreation (VADCR) office.

REVIEW OF TMDL DEVELOPMENT STUDIES

Thumb Run, Carter Run, Great Run, and Deep Run are part of the Rappahannock River watershed, located in Fauquier and Stafford Counties, Virginia. Thumb Run, Carter Run and Great Run are located west of Town of Warrenton with Deep Run located to the southeast (Figure 1). The Thumb Run watershed is approximately 21,780 acres of which forested (49%) and agricultural (51%) land uses dominate. The Deep Run watershed is approximately 17,280 acres (78% forested and 21% agricultural land uses). Area of the Great Run watershed is approximately 18,090 acres, with forest as the primary land use (51%) followed by agricultural (46%) and residential (3%) land uses. The Carter Run watershed is approximately 35,580 acres comprised of forest (63%), agricultural (35%), and residential (2%) land uses (Figure 2).

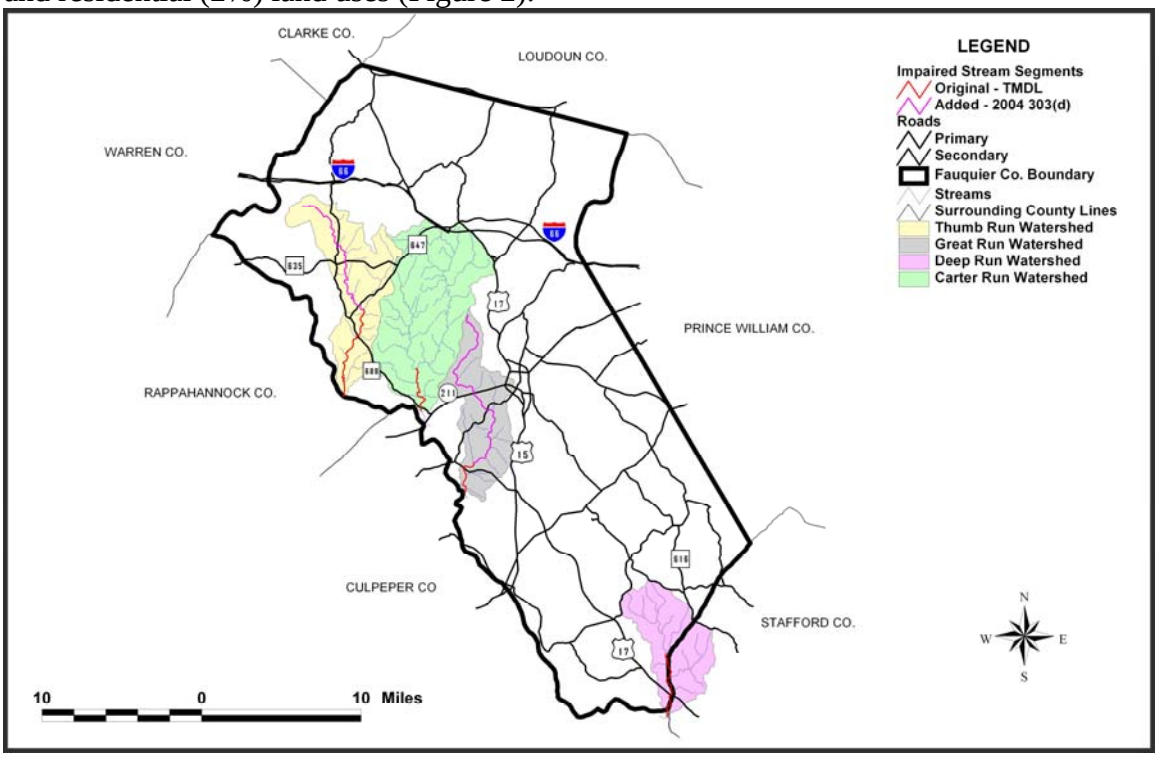


Figure 1. Thumb Run, Carter Run, Great Run, and Deep Run watersheds location.

Bacteria load reductions outlined in the TMDL development studies included:

- Exclusion of most/all livestock from streams is necessary within all impairments;
- Substantial land-based NPS load reductions are called for on pasture and cropland in Carter Run, Great Run, and Deep Run watersheds;
- All straight pipes and failing septic systems need to be identified and corrected in all impairments;
- Implicit in the requisite to correct straight pipes and failing septic systems is the requirement to maintain all properly functioning septic systems;

- Reductions of pet bacteria loads on residential land in Carter Run, Great Run, and Deep Run watersheds are necessitated; and
- Wildlife bacteria load reductions are necessary in Carter Run and Great Run watersheds based on bacterial source tracking data that was used to determine source reductions.

The TMDL IP focuses on human, pet, and livestock reductions. Water quality modeling has shown that the impairments can be removed from the impaired waters list by addressing human, pet, and livestock sources of bacteria. Wildlife reductions in Carter Run and Great Run watersheds will be handled through continued management by Virginia Department of Game and Inland Fisheries (VDGIF) and education. In addition, a use attainability analysis could be initiated to convert to a secondary contact designated use if water quality goals are not accomplished after addressing anthropogenic sources to the maximum extent practicable.

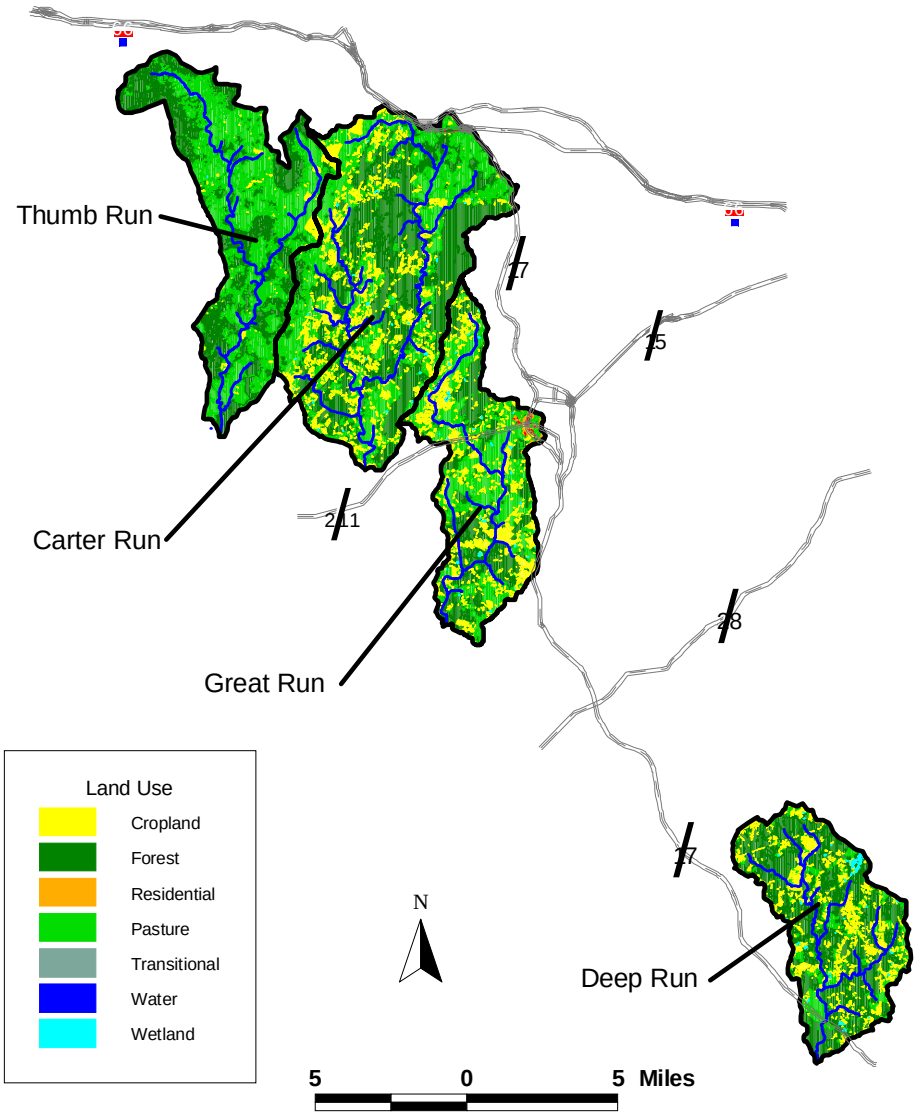


Figure 2. Land uses in the Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

PUBLIC PARTICIPATION

Process

The actions and commitments compiled in this document are formulated through input from citizens of the watersheds, the Fauquier and Stafford County governments, VADCR, Virginia Department of Environmental Quality (VADEQ), VDGIF, Virginia Department of Health (VDH), Virginia Cooperative Extension (VCE), John Marshall Soil and Water Conservation District (JMSWCD), Tri-County City Soil and Water Conservation District (TCCSWCD), Natural Resources Conservation Service (NRCS), Rappahannock-Rapidan Regional Commission (RRRC), and Engineering Concepts, Inc. (ECI). Every citizen and interested party in the watersheds is encouraged to put the implementation plan into action and contribute what they are able to help restore the health of the streams.

Public participation took place during IP development on three levels. First, public meetings were held to provide an opportunity for informing the public as to the end goals and status of the project, as well as, a forum for soliciting participation in the smaller, more-targeted meetings (i.e. working groups and steering committee). Second, working groups were assembled from communities of people with common concerns regarding the implementation process and were the primary arena for seeking public input. The following working groups were formed: Agricultural, Residential, and Governmental. A representative from VADCR, RRRC, or ECI attended each working group in order to facilitate the process and integrate information collected from the various communities. Third, a steering committee was formed with representation from the Agricultural, Residential, and Governmental Working Groups; VADCR; VADEQ; VDH; VDGIF; VCE; Fauquier County; Stafford County; JMSWCD; TCCSWCD; NRCS; RRRC; and ECI to guide the development of the IP. Over 640 man-hours were devoted to attending these meetings by individuals representing agricultural, residential, commercial, environmental, and government interests on a local, state, and federal level.

Throughout the public participation process, major emphasis was placed on discussing best management practices (BMPs), locations of control measures, education, technical assistance, monitoring, and funding.

Working Groups and Steering Committee Summary

The Agricultural Working Group (AWG) consisted predominantly of beef producers, agency representatives, and ECI personnel. The AWG is confident that current BMPs eligible for cost-share in TMDL areas and proposed recommendations will provide the necessary incentive for producers and horse owners to implement required BMPs to meet specified reductions to direct stream, pasture, and cropland loads. Challenges, recommendations, and keys for success discussed in the three meetings included:

- Participation from newer farmers, recreational farmers with smaller operations, and renters may be a challenge especially in Carter Run, Great Run, and Thumb Run.
- A full livestock exclusion system (i.e., SL-6 Grazing Land Protection) will be implemented to reduce direct stream loads. In order to allow incentive program participation by horse owners, it was requested that a hardened confinement area be

included in the SL-6 Grazing Land Protection specifications. Providing alternative shade for livestock excluded from stream corridor will reduce concentration of livestock at buffer edges. It is recommended that cost-share be provided for a shade structure to farmers with an acceptable livestock exclusion system.

- A new "Pasture Management System BMP" to provide incentive for control of upland pasture loads was recommended.
- An incentive payment is needed to entice farmers to convert cropland to vegetated buffers to help meet specified cropland load reductions.
- Individual contact with farmer to define TMDL, explain what it means to the farmer, and outline options for funding sources will be needed. Additional outreach includes field days, small workshops, field visits, and talks at association meetings. A statewide public service announcement through various media (*e.g.*, radio, newspapers, cable) paid by the Commonwealth about BMPs and incentive programs was also suggested.

The Residential Working Group (RWG) consisting predominantly of watershed residents, agency representatives, VADCR, and RRRC personnel focused on means to educate and involve public with regard to implementing corrective actions to replace straight pipes, correct failing septic systems, and manage pet waste. The following key topics and recommendations resulted from the two RWG meetings:

- An organized education and outreach program, with genuine incentives for participation, will be essential for the implementation effort to succeed. The Fauquier County Health Department is willing to accept responsibility to administer education and technical assistance efforts to address bacteria sources attributed to failing and inadequate on-site sewage disposal systems given technical assistance funding is available to hire a person.
- Several education/outreach techniques need to be utilized during implementation of corrective actions for straight pipes and failing septic systems. The focus must be on obstacles (*e.g.*, money, information, and understanding of issues) that property owners face in correcting problems and proper operation and maintenance of systems Examples included: newspaper articles, small community meetings, workshops, model septic system and video displayed in public buildings, demonstration at county fair, information packet provided through realtors on proper operation and maintenance of on-site sewage disposal systems, and mailings.
- BMPs listed under the cost-share program (*i.e.*, RB-1 through RB-5), pet waste control program (*i.e.*, signage, pet waste disposal stations, and distribution of educational information), vegetative buffers, and structural BMPs (*e.g.*, retention pond) were recommended control measures.

The Governmental Working Group (GWG) consisted predominantly of agency representatives, VADCR, RRRC, and ECI personnel. Key topics and recommendations resulting from two meetings included:

- State On-site Sewage Code requires new houses to have an average 1,000 square feet of land available for a replacement drainfield. Fauquier County ordinance requires a 200% reserve for non-service District areas and 100% reserve for service District areas.
- Fauquier County Code requires an annual inspection of alternative waste treatment systems. All homes built after 2003 must have the septic tank pumped once every 5 years.
- There are no County restrictions or ordinances that deal with the disposal of pet waste. The Town of Warrenton has a pet waste ordinance.
- A staged approach consisting of the pet waste control program, inventorying number of confined canine units (*i.e.*, hunt clubs, kennels, and veterinary hospitals), and demonstration sites for proper canine waste storage and management was outlined. Vegetative buffers and structural BMPs were recommeneded as a secondary course of action. GWG believes that Fauquier County is better suited to take on the responsibility of implementing the pet waste component of the IP with technical assistance from DCR, JMSWCD, and VDH.
- VDGIF's position is that increasing kill limits or bag limits for deer will not control overpopulations of deer in the County. There is not enough public land to hunt and the lack of access to private land is a significant issue that contributes to a lack of hunters to manage deer populations. Land use changes and the way residential landscapes are currently designed are contributing to increasing numbers of deer in residential areas. Canadian Geese are protected as a migratory waterfowl. Federal government tells VDGIF how many can be killed, current limit is five geese/per day. Vegetation along farm ponds would discourage geese access. GWG recommends that educational materials be prepared to help landowners understand why wildlife populations are increasing and the various options that are available to landowners to manage wildlife populations on their land. Educational funds made available during implementation phase should be directed at wildlife sources and management options, VDGIF is interested in helping to develop educational materials.
- The GWG members expressed to VADEQ staff the desire to have at least one continual monitoring station in each of the four watersheds beginning in 2006 to measure implementation progress.
- Other activities to be integrated with implementation include: Fauquier Riparian Easement Program Solutions Initiative, Fauquier County Water Resources Management Plan, Warrenton Reservoir Overlay Plan, Fauquier County Comprehensive Plan, Stafford County Comprehensive Plan, Low Impact Development strategies, and Chesapeake Bay Nutrient and Sediment Reduction Strategy for the Rappahannock River Basin.

Reports from each working group to the steering committee are included as appendices of the *Thumb Run, Carter Run, Great Run, and Deep Run Bacteria TMDL Implementation Plan Technical Report.*

The Steering Committee consisted of representatives from the AWG, RWG, and GWG, watershed residents, county personnel, government agencies, RRRC, and ECI. The

steering committee evaluated recommendations from working groups, reviewed BMP quantification and cost estimates, formulated pet waste reduction plan, discussed avenues to address wildlife reductions, devised monitoring plan, and discussed potential funding resources available. The steering committee will periodically revisit implementation progress and suggest plan revisions as needed.

IMPLEMENTATION ACTIONS

Assessment of Implementation Action Needs

The actions and cost needed in both implementation stages were identified and quantified. The overall numbers presented in Table 1 represent the Stage II goal of TMDL source allocation attainment, which is required under WQMIRA and by USEPA for eligibility to receive Section 319 grant funds to apply during implementation. An assessment was also conducted to quantify actions and cost to meet source allocations that translate to an instantaneous standard violation rate of 10.5% or less resulting in removal of Thumb Run, Carter Run, Great Run and Deep Run from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. This is referred to as the Stage I implementation goal.

The quantity of control measures, or BMPs, required during implementation was determined through spatial analyses of land use, stream-network, and the Commonwealth of Virginia aerial maps along with regionally appropriate data archived in the DCR Agricultural BMP Database and TMDL Development documents. The map layers and archived data were combined to establish average estimates of control measures required overall and in each watershed. Additionally, input from local agency representatives, citizens, and contractors were used to verify the analyses. Estimates of control practices needed for full implementation in the four watersheds are listed in Table 1.

There are approximately 97 miles of perennial streams in the four watersheds. The total length of fencing required on perennial streams in the four watersheds is approximately 68 miles of fence. This exclusion fencing is translated into 167 Grazing Land Protection Systems (SL-6) to be installed during Stage I to insure full exclusion of livestock from the streams. A typical SL-6 system includes streamside fencing for perennial and intermittent streams, cross-fencing for pasture management, hardened crossings, alternative watering systems, and a 35-ft buffer from the stream.

A proposed pasture management system BMP to provide incentive for control of upland pasture loads is recommended with the following anticipated criteria:

- Must have NRCS specified livestock exclusion system installed;
- Must have soil testing performed applying lime and fertilizer based on testing results allowing nutrients to be more readily available resulting in an improved stand.;
- Must maintain a 3-inch minimum grass height through the growing season per NRCS recommended specifications;
- Must mow pastures to control woody vegetation;
- Must chain harrow pasture to break-up manure piles after livestock are removed from field;
- Tax credit provided for chain harrow purchase; and

- Incentive payment of $200/ac provided.

In order to address pasture land reductions, the benefit of installing the SL-6 exclusion systems and pasture acreage incorporated in the proposed pasture management system BMP were calculated. Total of 16,270 acres in the four watersheds will be included in the pasture management system BMPs during Stage I. Given reductions were not sufficient to meet TMDL reduction goals, installation of retention ponds may be necessary to treat runoff from this acreage during Stage II of implementation. Conversion of approximately 3,200 cropland acres to vegetative buffers and manure incorporation into soil on approximately 5,334 cropland acres during Stage I was estimated to address required cropland reductions.

Table 1. Estimation of average control measures with unit cost needed to meet Stage II implementation goal for agricultural and residential programs in Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

Control Measure	Unit	Estimated Units Needed (#)	Unit Cost[3] ($)
Agricultural			
Livestock Exclusion System	system	167	20,000
Pasture Management System	acre[1]	16,270	200
Vegetative Buffer on Cropland	acre[1]	3,200	560
Manure / Biosolids Incorporation on Cropland	acre[1]	5,330	20
Retention Pond	acre[2]	16,270	2,000
Technical Assistance	FTE	20	60,000
Administrative Assistance	FTE	10	45,000
Residential			
Alternative Sewage Disposal System	system	44	25,000
New Septic System	system	146	7,000
Repaired Septic System	system	102	3,500
Pet Waste Control Program	system	3	3,750
Confined Canine Unit Demonstration Project	system	2	20,000
Confined Canine Unit Treatment System	system	25	5,000
Landscape BMP Demonstration Project	system	2	20,000
Retention Pond	acre[2]	797	2,000
Infiltration Trench	acre[2]	265	9,000
Rain Garden	acre	265	12,000
Technical Assistance	FTE	15	60,000
Administrative Assistance	FTE	8	45,000

[1]Acres installed, [2]Acres treated, [3]Unit cost = installation or one-time incentive payment

The number of straight pipes and failing septic systems were based on numbers reported in the TMDL documents. It was decided that budgeting should be based on correcting all systems identified. It was assumed that half the straight pipes would be replaced with a conventional septic system and half replaced with an alternative sewage disposal system. Failing septic systems were assumed to be corrected by repairing the existing septic system (40%), installing a new conventional septic system (50%), or installing a new

alternative sewage disposal system (10%). It is estimated that 102 septic system repairs, 146 conventional septic systems, and 44 alternative sewage disposal systems are considered necessary to correct straight pipes and failing septic systems in the four watersheds during Stage I (Table 1). A four-step program was proposed to address pet waste reductions. In the first step, a pet waste control program consisting of educational packets, signage, and disposal stations in public areas will be instituted. Identification of confined canine units (CCU), conducting two CCU waste treatment demonstration projects, and installing approximately 25 CCU waste treatment systems will comprise the second step. The third step will be to conduct two demonstration projects to promote landscape BMP installation to homeowners. Steps one through three will be completed during Stage I of implementation. If necessary, the fourth step occurring during Stage II will be BMP installations to treat storm water runoff. It was estimated that treatment of storm water runoff from 797 acres by retention ponds, 265 acres by infiltration trenches, and 265 acres by rain gardens, may be necessary. Components of the four-step program are outlined in Table 1.

Assessment of Technical Assistance Needs

To determine the number of full time equivalents (FTE) considered necessary for agricultural technical assistance during implementation, the total number of practices needed to be installed per year during implementation was divided by the number of BMPs that one FTE can process in a year. It was assumed that all BMPs would need some level of technical assistance and the FTE would be responsible for educational outreach. Coupling the number of BMPs processed historically and estimates provided by JMSWCD, two FTE providing technical assistance and one FTE providing administrative assistance for the agricultural program are needed throughout implementation. Members of the RWG and GWG estimated that one technical FTE and half administrative FTE would be required throughout implementation to provide technical assistance and educational outreach tasks to correct onsite sewage disposal system problems. Members of the RWG, GWG, and steering committee estimated a half technical FTE and quarter administrative FTE throughout implementation would be required to address pet waste reductions. The number of FTE needed to provide assistance during implementation in the four watersheds is listed in Tables 2 and 3.

Cost Analysis

Associated cost estimations for each implementation action during Stages I and II were calculated by multiplying the average unit cost per the number of units in each impairment shown in Table 1. The total average installation cost for full livestock exclusion systems and pasture management system BMPs in the four watersheds is $3.34 million and $3.25 million, respectively. The total installation cost for control measures to obtain the cropland land-applied reductions in the four watersheds is estimated at $1.90 million. Estimated corrective action costs needed to replace straight pipes and fix failing septic systems totaled $2.48 million excluding technical assistance. The cost to implement the first three steps of the pet waste reduction process total cost an estimated

$0.22 million excluding technical assistance. Cost to implement actions to meet the Stage II goal is contained in Table 5.

It was determined by the JMSWCD, VADCR, VDH, GWG, and steering committee members that it would require $60,000 and $45,000 to support the salary, benefits, travel, and training of one technical FTE and administrative FTE, respectively. The total cost to provide assistance in the agricultural and residential programs during Stage I implementation is expected to be $0.83 million and $0.62 million, respectively. Technical assistance cost for Stage II is listed in Table 5. The total implementation cost including technical assistance is $12.63 million with the agricultural cost being $9.32 million and the residential cost $3.31 million.

Benefit Analysis

Human Health

The primary benefit of implementation is cleaner waters in Virginia, where bacteria levels in Thumb Run, Carter Run, Great Run, and Deep Run will be reduced to meet water quality standards. It is hard to gage the impact that reducing fecal contamination will have on public health, as most cases of waterborne infection are not reported or are falsely attributed to other sources. However, the incidence of infection from fecal sources, through contact with surface waters, should be reduced considerably. The residential programs will play an important role in improving water quality, since human waste can carry with it human viruses in addition to the bacterial and protozoan pathogens that all fecal matter can potentially carry.

Aquatic Community Improved, Nutrient and Sediment Load Reductions

Stream bank protection provided through exclusion of livestock from streams will improve the aquatic habitat in these streams. Vegetated buffers that are established will also help reduce sediment and nutrient transport to the stream from upslope locations. The installation of improved pasture management systems should also reduce soil and nutrient losses, increase infiltration of precipitation thereby decreasing peak flows downstream. Reductions in nutrient and sediment loadings contribute to attainment of nutrient and sediment reduction goals for the Commonwealth of Virginia Chesapeake Bay Nutrient and Sediment Reduction Tributary Strategy for the Rappahannock River and Northern Neck Coastal Basins, April 2004. Local initiatives, such as Fauquier County Riparian Easement Program, will additionally be complemented by actions performed during TMDL implementation.

Economics

An important objective of the IP is to foster continued economic vitality and strength. Healthy waters can improve economic opportunities for Virginians, and a healthy economic base can provide the resources and funding necessary to pursue restoration and enhancement activities. The agricultural and residential practices recommended in this document will provide economic benefits to the landowner, along with the expected environmental benefits. For example, exclusion of cattle from streams leads to the development of alternative (clean) water sources, improved pasture management, and private sewage system maintenance will each provide economic benefits. Additionally,

money spent by landowners, government agencies, and non-profit organizations in the process of implementing the IP will stimulate the local economy.

The benefit of a pasture management system BMP is improved profit through more efficient utilization and harvest of forage by grazing animals. Standing forage utilized directly by the grazing animal is always less costly and of higher quality than the same forage harvested with equipment and fed to the animal (VCE, 1996). Several factors contribute to greater profitability: stocking rate can usually be increased by 30% to 50%; high-quality, fresh, and unsoiled vegetative growth available throughout the grazing system increases weight gain per acre; vigor of the pasture sod is improved; and handling and checking grazing animals is easier. More accurate estimates of the amount of forage available, greater uniformity in grazing of pastures, flexibility of harvesting and storing forage not needed for grazing, and extending the length of the grazing season while providing a more uniform quality and quantity of forage throughout the season are important benefits afforded by this system (VCE, 1996).

In terms of economic benefits to homeowners, an improved understanding of private sewage systems, including knowledge of what steps can be taken to keep them functioning properly and the need for regular maintenance, will give homeowners the tools needed for extending the life of their systems and reducing the overall cost of ownership. In addition, investment in the home is protected with a properly functioning sewage disposal system. A home's value can be decreased up to 40% with a failed septic system (Shepherd, 2006). The average septic system will last 20-25 years if properly maintained. Proper maintenance includes; knowing the location of the system components and protecting them by not driving or parking on top of them, not planting trees where roots could damage the system, keeping hazardous chemicals out of the system, and pumping out the septic tank every three to five years. The cost of proper maintenance, as outlined here, is relatively inexpensive in comparison to repairing or replacing an entire system.

Livestock Herd Health

A clean water source coupled with exclusionary fencing has been shown to increase weight gains; decrease stress; reduce herd health risks associated with increased exposure to water-transmitted diseases, bacteria, virus and cysts infections; reduce mastitis and foot rot; and decrease herd injuries associated with cattle climbing unstable streambanks or being stuck in mud.

MEASUREABLE GOALS AND MILESTONES

The end goals of implementation are:

1) Restored water quality in the impaired waters, and
2) Subsequent de-listing of streams from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters.

Progress toward end goals will be assessed during implementation through tracking of control measure installations by JMSWCD, TCCSWCD, VDH, VADCR, Fauquier

County, and Stafford County. The VADEQ will continue to assess water quality through its monitoring program. Other monitoring project activities in the watersheds (e.g., Thumb Run *E. coli* Coliscan Monitoring Project) will be coordinated with VADEQ to augment the VADEQ monitoring program.

Implementation will occur over 10 years and be assessed in two stages. Stage I is based on meeting source allocations that translate to an instantaneous standard violation rate of 10.5% or less resulting in removal of Thumb Run, Carter Run, Great Run and Deep Run from the Commonwealth of Virginia's Section 303(d) List of Impaired Waters. The Stage II goal is based on implementing source allocations to meet the specified TMDL goal, 0% violation of water quality standards. Implementation of control measures is scheduled for nine years beginning in June 2006 lasting to June 2015 (Tables 2 and 3). After implementation inception, five milestones will be met in Stage I, one milestone at the end of Stage I in the fifth year, three milestones in Stage II, and a final milestone in year ten (Table 4).

Implementation in years one through five for agricultural source reductions focuses on livestock exclusion, pasture management systems, vegetative buffers on cropland, and manure incorporation on cropland. BMPs installed in years six through nine are based on additional treatment of runoff from pasture land using storm water BMPs to remove remaining bacteria load not treated with the pasture management systems installed during Stage I. These storm water BMPs (*i.e.*, retention ponds) are more costly and are logistically more difficult to design and locate on individual farms.

Implementation in years one through five for residential bacteria loads focuses on identification and removal of straight pipes, repairing or replacing failed septic systems, a pet waste control program, installation of storage and treatment systems for waste from confined canine units (CCU), and a storm water management landscape demonstration. BMPs to be installed in years six through nine are based on treating runoff from residential areas where pet waste is still considered a source contributing to the bacteria standard violations. The storm water runoff would be treated with retention ponds, infiltration trenches, and rain gardens.

An instantaneous water quality standard violation rate from 8% to 12% is anticipated, based on water quality modeling projections when the fifth year implementation milestone equaling 100% installation of agricultural BMPs (excluding retention ponds), residential on-site sewage disposal systems, and a pet waste control program that includes storage and treatment of waste from CCUs (Table 4). The four impaired streams would be in a probable position to be de-listed upon attainment of the Stage I goal. Milestone six occurring in the fifth year is attainment of the Stage I goal. If the water quality has not improved to the point that the streams can be de-listed upon attaining the Stage I implementation goal a process could be initiated (*i.e.*, use attainability analysis) to change the designated use of Thumb Run, Carter Run, Great Run, and Deep Run. The current designated use is full contact recreation, which includes swimming. Virginia allows the adoption of a secondary contact designated use in the case that human, livestock, and pet

sources are addressed to the maximum extent practicable and water quality goals are not being obtained.

The process of a staged implementation implies targeting of control measures, ensuring optimum utilization of resources. In quantifying agricultural BMPs through the use of aerial, landuse, farm tracts, and stream network GIS layers, maps were formulated showing potential livestock access, crop fields, and pastures per farm tract. Map created of the Great Run watershed is depicted in Figure 3. These maps identify farm tracts that JMSWCD and TCCSWCD should concentrate efforts in. Owners will be contacted and progression through BMP installation will be tracked. Known problem areas, clusters of older homes, or houses in close proximity to streams known by the VDH will be targeted for onsite treatment system control measures. Steps outlined in pet waste BMP stages results in targeting of source type and resources.

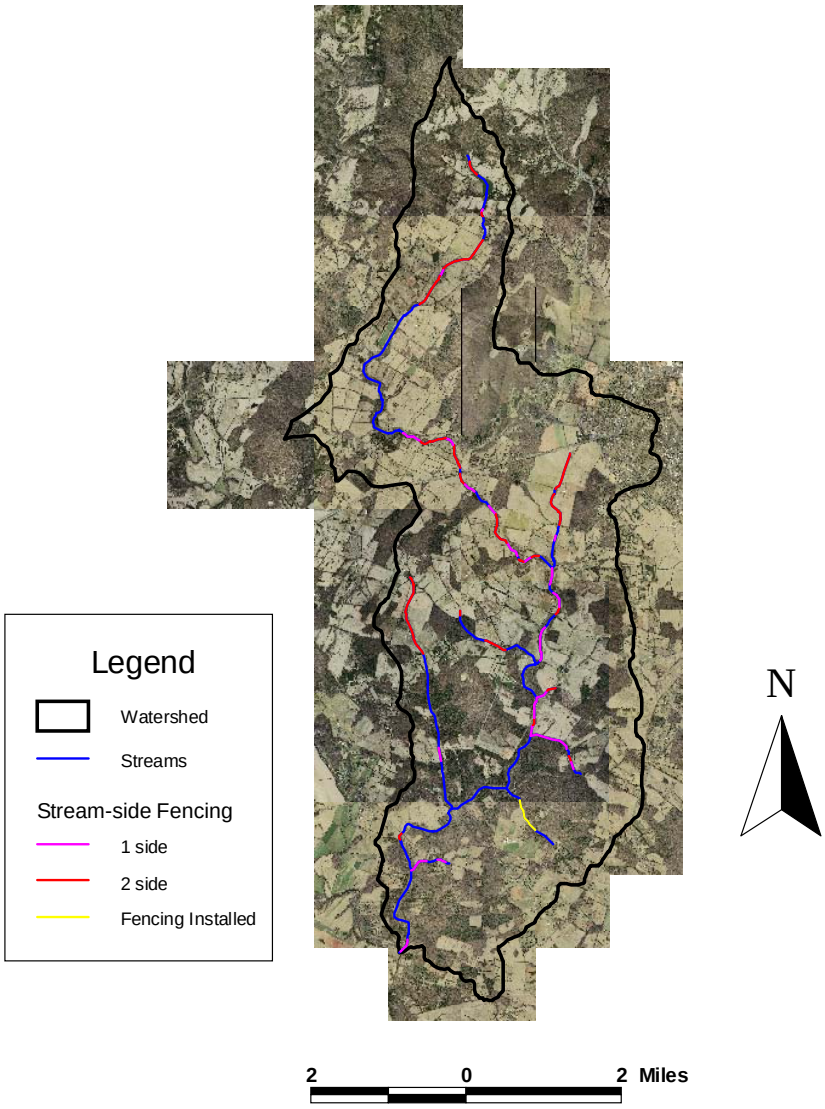


Figure 3. Potential livestock exclusion fencing map for Great Run watershed.

Table 2. Percentage of practices to be installed addressing livestock exclusion and land-applied reductions with amount of technical assistance needed in Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

Year	Livestock Exclusion Systems		Pasture Management System		Vegetative Buffers		Manure Incorporation		Retention Pond		Tech. Assist.	Admin. Assist.
	(%)	(#)	(%)	(ac[1])	(%)	(ac[2])	(%)	(ac[2])	(%)	(ac[1])	(FTE[3])	(FTE)
1	10	17	10	1,627	10	320	10	533	0	0	2.0	1.0
2	20	33	20	3,254	20	640	20	1,067	0	0	2.0	1.0
3	20	33	20	3,254	20	640	20	1,067	0	0	2.0	1.0
4	30	50	30	4,881	30	960	30	1,600	0	0	2.0	1.0
5	20	34	20	3,254	20	640	20	1,067	0	0	2.0	1.0
6	0	0	0	0	0	0	0	0	24	3,905	2.0	1.0
7	0	0	0	0	0	0	0	0	24	3,905	2.0	1.0
8	0	0	0	0	0	0	0	0	26	4,230	2.0	1.0
9	0	0	0	0	0	0	0	0	26	4,230	2.0	1.0
10	0	0	0	0	0	0	0	0	0	0	2.0	1.0
Total	**100**	**167**	**100**	**16,270**	**100**	**3,200**	**100**	**5,334**	**100**	**16,270**	**20.0**	**10.0**

[1] Acres treated.
[2] Acres installed
[3] Implementation will begin with one FTE.

Table 3. Percentage of practices to be installed addressing straight pipes, failing septic systems, and land-applied pet waste reductions with amount of technical assistance needed in Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

Year	Straight Pipes Corrected		Failed Septic System Corrected		Pet Waste Control Program		CCU Demo.		CCU Treatment System		Landscape Demo.		Retention Pond		Infiltration Trench		Rain Garden		TA	AA
	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(#)	(%)	(ac[1])	(%)	(ac[1])	(%)	(ac[1])	(FTE)	(FTE)
1	20	7	20	51	100	3	50	1	0	0	0	0	0	0	0	0	0	0	1.5	0.75
2	20	7	20	51	0	0	50	1	40	10	0	0	0	0	0	0	0	0	1.5	0.75
3	20	7	20	51	0	0	0	0	60	15	0	0	0	0	0	0	0	0	1.5	0.75
4	20	8	20	51	0	0	0	0	0	0	100	1	0	0	0	0	0	0	1.5	0.75
5	20	8	20	51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0.75
6	0	0	0	0	0	0	0	0	0	0	0	0	20	159	20	53	20	53	1.5	0.75
7	0	0	0	0	0	0	0	0	0	0	0	0	20	159	20	53	20	53	1.5	0.75
8	0	0	0	0	0	0	0	0	0	0	0	0	20	159	20	53	20	53	1.5	0.75
9	0	0	0	0	0	0	0	0	0	0	0	0	40	319	40	106	40	106	1.5	0.75
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1.5	0.75
Total	**100**	**37**	**100**	**255**	**100**	**3**	**100**	**2**	**100**	**25**	**100**	**1**	**100**	**797**	**100**	**265**	**100**	**265**	**15.0**	**7.50**

[1] Acres treated. CCU = Confined Canine Unit; Demo. = Demonstration; TA = Technical Assistance; AA = Administrative Assistance

Table 4. Implementation and water quality milestones for Thumb Run, Carter Run, Great Run, and Deep Run watersheds .

Milestone	Stage	Date	Implementation Milestones								Water Quality Milestone			
			Livestock Exclusion Systems (%)	Pasture Management System BMPs (%)	Cropland Land-Applied BMPs (%)	Retention Ponds (%)	Straight Pipes (%)	Failing Septic Systems (%)	Stage I Pet Waste BMPs (%)	Stage II Pet Waste BMPs (%)	Instantaneous Water Quality Standard Exceedance in:			
											Carter Run[1] (%)	Great Run[1] (%)	Thumb Run[2] (%)	Deep Run[1] (%)
0		6/1/06	Implementation Begins								34	35	35	35
1	I	6/1/07	10	10	10	---	20	20	20	---	30	31	32	35
2		6/1/08	30	30	30	---	40	40	40	---	20	25	28	33
3		6/1/09	50	50	50	---	60	60	60	---	16	22	23	29
4		6/1/10	80	80	80	---	80	80	80	---	10	11	14	21
5		6/1/11	100	100	100	---	100	100	100	---	10	11	8	12
6		12/1/11	De-listing from Section 303(d) List of Impaired Waters											
7	II	6/1/12	---	---	---	24	---	---	---	20	8	7	0	8
8		6/1/13	---	---	---	48	---	---	---	40	4	5	0	4
9		6/1/14	---	---	---	74	---	---	---	60	4	5	0	0.16
10		6/1/15	---	---	---	100	---	---	---	100	0	0	0	0
11		6/1/16	TMDL Load Allocations Attained											

[1] Exceedance based on instantaneous *E. coli* standard of 235 cfu/100ml.
[2] Exceedance based on instantaneous fecal coliform standard of 1,000 cfu/100ml.

Table 5. Implementation cost associated with percentage of practices installed addressing agricultural and residential practices along with technical assistance needed in Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

	Agricultural				Residential						
Year	**Livestock Exclusion Systems**	**Land-applied BMPs**	**Tech Assist.**	**Total Agric. Cost**	**Straight Pipe Corrected**	**Failed Septic System Corrected**	**OSSDS Tech. Assist.**	**Pet Waste Reductions**	**Pet Waste Tech. Assist.**	**Total Res. Cost**	**Total Cost**
	($)	**($)**	**($)**	**($)**	**($)**	**($)**	**($)**	**($)**	**($)**	**($)**	**($)**
1	334,000	515,000	165,000	1,014,000	118,400	377,400	83,000	31,000	41,000	650,800	1,664,800
2	668,000	1,030,000	165,000	1,863,000	118,400	377,400	83,000	70,000	41,000	689,800	2,552,800
3	668,000	1,030,000	165,000	1,863,000	118,400	377,400	83,000	75,000	41,000	694,800	2,557,800
4	1,002,000	1,546,000	165,000	2,713,000	118,400	377,400	83,000	20,000	41,000	639,800	3,352,800
5	668,000	1,030,000	165,000	1,863,000	118,400	377,400	83,000	20,000	41,000	639,800	2,502,800
6	0	7,810,000	165,000	7,975,000	0	0	0	1,434,000	41,000	1,475,000	9,450,000
7	0	7,810,000	165,000	7,975,000	0	0	0	1,434,000	41,000	1,475,000	9,450,000
8	0	8,461,000	165,000	8,626,000	0	0	0	1,434,000	41,000	1,475,000	10,101,000
9	0	8,461,000	165,000	8,626,000	0	0	0	2,868,000	41,000	2,909,000	11,535,000
10	0	0	165,000	165,000	0	0	0	0	41,000	41,000	206,000
Total (1-5)	**3,340,000**	**5,151,000**	**825,000**	**9,316,000**	**592,000**	**1,887,000**	**415,000**	**216,000**	**205,000**	**3,315,000**	**12,631,000**
Total (1-10)	**3,340,000**	**37,693,000**	**1,650,000**	**42,683,000**	**592,000**	**1,887,000**	**415,000**	**7,386,000**	**410,000**	**10,690,000**	**53,373,000**

Monitoring

Implementation progress success will be determined by water quality monitoring conducted by VADEQ through the agency's monitoring program. VADEQ will monitor at nine monitoring locations in the Thumb Run, Carter Run, Great Run and Deep Run watersheds (Figure 4 and Table 6). Station 3-DPR001.70 in the Deep Run watershed is an ambient trend station and will be monitored indefinitely on a bi-monthly basis during implementation. The remaining eight ambient stations will be monitored on a bi-monthly basis from January 2006 through December 2007, after which monitoring continuation by VADEQ beyond this period will be evaluated. A separate *E. coli* coliscan monitoring project with 10 stations located throughout the Thumb Run watershed is currently underway. The JMSWCD has the lead for this project. Monitoring stations description and location are depicted in Table 7 and Figure 5. Monitoring results are accessible on the VADEQ website (http://www.deq.state.va.us/water/).

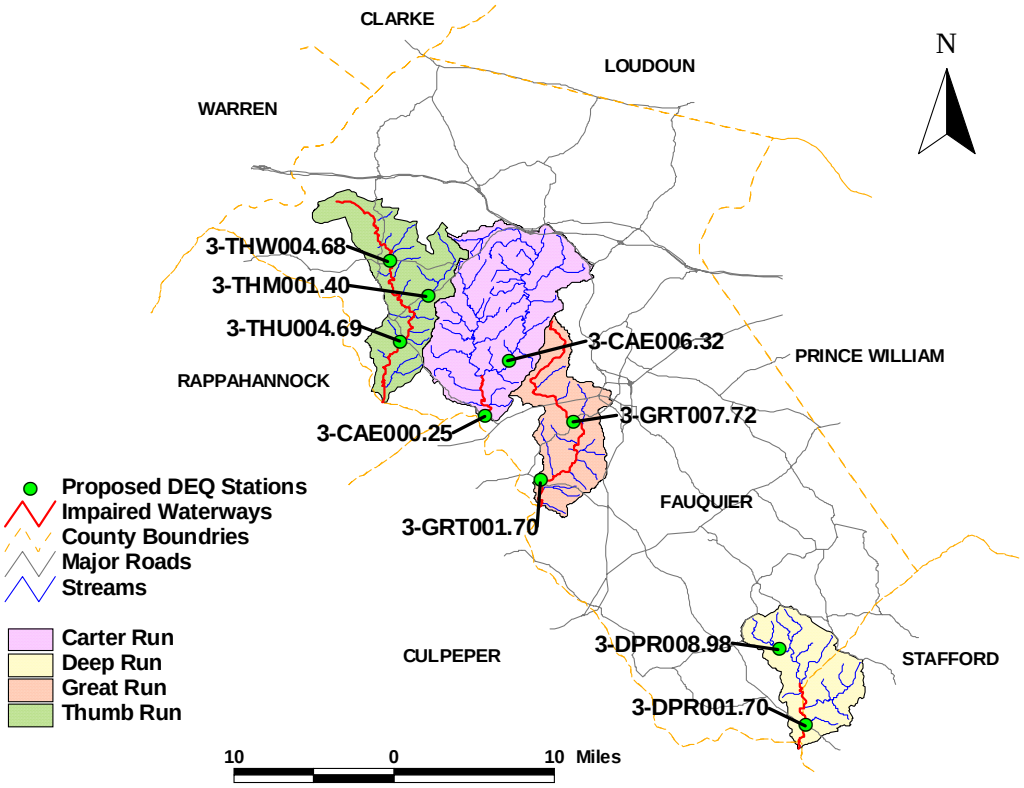


Figure 4. Location of VADEQ monitoring stations.

Table 6. VADEQ monitoring station IDs, locations, type, and monitoring schedules in Thumb Run, Carter Run, Great Run, and Deep Run watersheds.

Station ID	Station Location	Station Type	Monitoring Period
3-THW004.68	West Branch Thumb Run @ Rt. #635 (Humes Rd.)	Ambient Watershed	01/06 – 12/07
3-THM001.40	East Branch Thumb Run @ Rt. #647 (Cresthill Rd.)	Ambient	01/06 – 12/07
3-THU004.69	Thumb Run @ Rt. 688 (Leeds Manor Rd.)	Ambient Watershed	01/06 – 12/07
3-CAB006.32	Carter Run @ Rt. #738	Ambient Watershed	01/06 – 12/07
3-CAB000.25	Carter Run @ Rt. #688	Ambient Watershed	01/06 – 12/07
3-GRT007.72	Great Run @ Rt. #802	Ambient Watershed	01/06 – 12/07
3-GRT001.70	Great Run @ Rt. #687	Ambient Watershed	01/06 – 12/07
3-DPR008.98	Deep Run @ Rt. #634	Ambient	01/06 – 12/07
3-DPR001.70	Deep Run @ Rt. #17	Ambient Trend	01/06 – indefinite

Table 7. Description of *E. coli* coliscan stations in Thumb Run watershed.

Sample Site #	Station Location	Comments	Monitoring Period
TR1	Main Branch Thumb Run at Rt. 736 bridge	Gravel road, wooden bridge	10/05 – 09/06
TR2	Main Branch at Rt. 688 bridge	Tall bridge, need rope and tube	10/05 – 09/06
TR3	West Branch on Rt. 647, 1 mile north of Rt. 688	Just past Rosewood Lane	10/05 – 09/06
TR4	West Branch on Rt. 635, .5 mile east of Hume	None	10/05 – 09/06
TR5	West Branch on Rt. 688 at Leeds Chapel Rd.	Just before Leeds Episcopal Church	10/05 – 09/06
TR6	West Branch on Canaan Road west of Rt. 688	Canaan Road is opposite of Rt. 729	10/05 – 09/06
TR7	West Branch on Rt. 728	Site is just past Sunnyside Lane	10/05 – 09/06
TR8	East Branch on Rt. 732	Near intersection with Rt. 724	10/05 – 09/06
TR9	East Branch on Rt. 635	Just west of Rt. 647 interesction	10/05 – 09/06
TR10	East Branch on Rt. 647	Vernon Mills on topo map	10/05 – 09/06

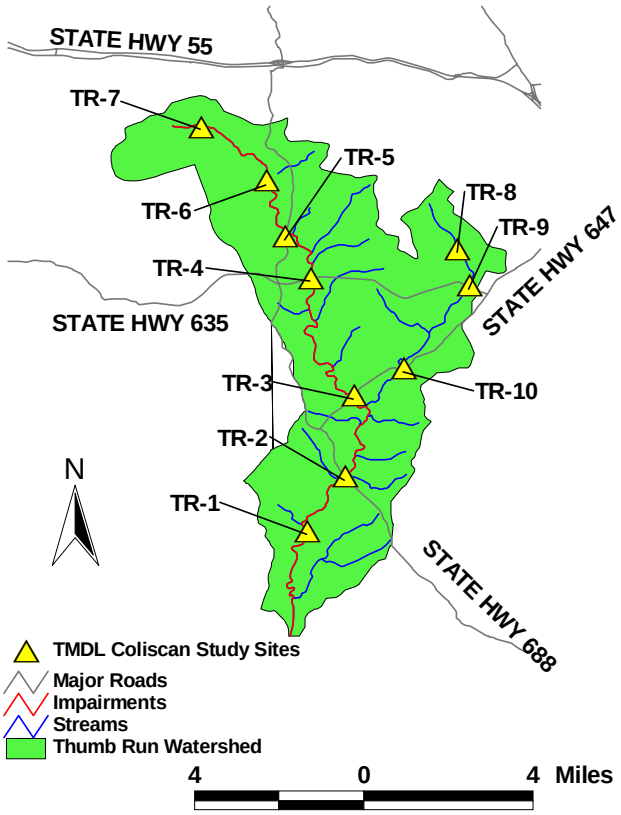


Figure 5. *E.coli* coliscan station locations in Thumb Run watershed.

STAKEHOLDER'S ROLES AND RESPONSIBILITIES

Stakeholders are individuals who live or have land management responsibilities in the watershed, including government agencies, businesses, private individuals and special interest groups. Successful implementation depends on stakeholders taking responsibility for their role in the process, the primary role falls on the local groups that are most affected; that is, businesses, community watershed groups, and citizens. However, local, state and federal agencies also have a stake in seeing that Virginia's waters are clean and provide a healthy environment for its citizens. Stakeholder participation and support is essential for achieving the goals of this TMDL effort (*i.e.*, improving water quality and removing streams from the impaired waters list). Virginia's approach to correcting non-point source pollution problems continues to be encouragement of participation through education and financial incentives; that is, outside of the regulatory framework. If, however, voluntary approaches prove to be ineffective, it is likely that implementation will become less voluntary and more regulatory.

The roles and responsibilities of some of the major stakeholders on a federal, state, and local level are as follows:

USEPA: The USEPA has the responsibility of overseeing the various programs necessary for the success of the CWA. However, administration and enforcement of such programs falls largely to the states.

NRCS: The NRCS is the federal agency that works hand-in-hand with the American people to conserve natural resources on private lands. NRCS assists private landowners with conserving their soil, water, and other natural resources. Local, state and federal agencies and policymakers also rely on the expertise of NRCS staff. NRCS is also a major funding stakeholder for impaired water bodies through the Conservation Reserve Enhancement Program (CREP) and the Environmental Quality Incentive Program (EQIP).

In the Commonwealth of Virginia, water quality problems are dealt with through legislation, incentive programs, education, and legal actions. State government has the authority to establish state laws that control delivery of pollutants to local waters. Local governments in conjunction with the state can develop ordinances involving pollution prevention measures. In addition, citizens have the right to bring litigation against persons or groups of people who can be shown to be causing some harm to the claimant. Through hearing the claims of citizens in civil court, and the claims of government representatives in criminal court, the judicial branch of government also plays a significant role in the regulation of activities that impact water quality. Currently, there are five state agencies responsible for regulating and/or overseeing statewide activities that impact water quality associated with bacteria in Virginia. These agencies include: VADEQ, VADCR, Virginia Department of Agriculture and Consumer Services (VDACS), VDH, and VCE.

VADEQ: The State Water Control Law authorizes the State Water Control Board to control and plan for the reduction of pollutants impacting the chemical and biological quality of the State's waters resulting in the degradation of the swimming, fishing, shell fishing, aquatic life, and drinking water uses. For many years the focus of VADEQ's pollution reduction efforts was the treated effluent discharged into Virginia's waters via the VPDES permit process. The TMDL process has expanded the focus of VADEQ's pollution reduction efforts from the effluent of wastewater treatment plants to the pollutants causing impairments of the streams, lakes, and estuaries. The reduction tools are being expanded beyond the permit process to include a variety of voluntary strategies and BMPs. VADEQ is the lead agency in the TMDL process. The Code of Virginia directs VADEQ to develop a list of impaired waters, develop TMDLs for these waters, and develop IPs for the TMDLs. VADEQ administers the TMDL process, including the public participation component, and formally submits the TMDLs to USEPA and the State Water Control Board for approval. VADEQ is also responsible for implementing point source WLAs, assessing water quality across the state, and conducting water quality standard related actions.

VADCR: The VADCR is authorized to administer Virginia's NPS pollution reduction programs in accordance with §10.1-104.1 of the Code of Virginia and §319 of the Clean Water Act. USEPA is requiring that much of the §319 grant monies be used for the development of TMDLs. Because of the magnitude of the NPS component in the TMDL

process, VADCR is a major participant the TMDL process. VADCR has a lead role in the development of IPs to address correction of NPSs contributing to water quality impairments. VADCR also provides available funding and technical support for the implementation of NPS components of IPs. The staff resources in VADCR's TMDL program focus primarily on providing technical assistance and funding to stakeholders to develop and carry out IPs, and support to VADEQ in TMDL development related to NPS impacts. VADCR staff will also be working with other state agencies, Soil and Water Conservation Districts, and watershed groups to gather support and to improve the implementation of TMDL plans through utilization of existing authorities and resources.

VDACS: The VDACS Commissioner of Agriculture has the authority to investigate claims that an agricultural producer is causing a water quality problem on a case-by-case basis (Pugh, 2001). If deemed a problem, the Commissioner can order the producer to submit an agricultural stewardship plan to the local soil and water conservation district. If a producer fails to implement the plan, corrective action can be taken, which may include civil penalties. The Commissioner of Agriculture can issue an emergency corrective action if runoff is likely to endanger public health, animals, fish and aquatic life, public water supply, *etc*. An emergency order can shut down all or part of an agricultural activity and require specific stewardship measures.

Fauquier County Health Department: The Fauquier County Health Department is responsible for maintaining safe drinking water measured by standards set by the USEPA. Their duties also include septic system regulation and regulation of biosolids land application. Like VDACS, VDH is complaint driven. Complaints can range from a vent pipe odor that is not an actual sewage violation and takes very little time to investigate, to a large discharge violation that may take many weeks or longer to effect compliance. For TMDLs, VDH has the responsibility of enforcing actions to correct failed septic systems and/or eliminate straight pipes (Sewage Handling and Disposal Regulations, 12 VAC 5-610-10 *et seq*.). The VDH has accepted the responsibility of working with landowners to implement the corrective actions to remove straight pipes and failing on-site sewage disposal systems and provide educational information and coordinate programs/events.

VCE: VCE is an educational outreach program of Virginia's land grant universities (Virginia Tech and Virginia State University), and a part of the national Cooperative State Research, Education, and Extension Service, an agency of the United States Department of Agriculture. VCE is a product of cooperation among local, state, and federal governments in partnership with citizens. VCE offers educational programs and technical resources for topics such as crops, grains, livestock, poultry, dairy, natural resources, and environmental management. VCE has published several publications that deal specifically with TMDLs. For more information on these publications and to find the location of county extension offices, visit www.ext.vt.edu. VCE has agreed to promote education and provide outreach to citizens, businesses, and developers regarding necessary pet waste reductions.

Local government groups work closely with state and federal agencies throughout the TMDL process; these groups possess insights about their community that may help to ensure the success of TMDL implementation. These stakeholders have knowledge about a community's priorities, how decisions are made locally, and how the watershed's residents interact. Some local government groups and their roles in the TMDL process are listed here:

JMSWCD & TCCSWCD: The JMSWCD and TCCSWCD are local units of government responsible for the soil and water conservation work within Fauquier and Stafford counties, respectively. The district's overall role is to increase voluntary conservation practices among farmers, ranchers and other land users Specific to the TMDL implementation, the districts will lead education and technical assistance efforts and track BMP implementation for the agricultural program.

Fauquier and Stafford County Government Departments: Government staff will work closely with local and state agencies, citizens, and the RRRC to implement the TMDLs.

RRRC: Environmental planning is a long-standing area of emphasis of the RRRC, which is complementary to the TMDL process. RRRC continues to promote efficient development of the environment by assisting and encouraging local governmental agencies to plan for the future. TMDL development and implementation plan development have been contracted through the RRRC. The RRRC will continue to work with VADCR and the Steering Committee to periodically revisit implementation progress and suggest plan revisions as needed.

Citizens & Businesses: The primary role of citizens and businesses is simply to get involved in the TMDL process. This may include participating in public meetings, assisting with public outreach, providing input about the local watershed history, and/or implementing best management practices to help restore water quality.

INTEGRATION WITH OTHER WATERSHED PLANS

Each watershed within the state is under the jurisdiction of a multitude of individual yet related water quality programs and activities, many of which have specific geographical boundaries and goals. These include but are not limited to, the Chesapeake Bay 2000 agreement, Tributary Nutrient Reduction Plans, TMDLs, roundtables, Water Quality Management Plans, sediment and erosion control regulations, stormwater management, Source Water Assessment Program, local comprehensive plans, and much more. The progress of these projects or programs needs continuous evaluation to determine possible effects on implementation goals. For example, financial and technical resources may be maximized for implementation by coordinating and expanding the planning and implementation activities of these on-going watershed projects or programs. Recent initiatives within Fauquier County include:

Fauquier County Riparian Easement Program

Initiated in August 2005, the program is a cooperative effort among regional and county agencies and local non-profits to secure riparian easements for the purpose of improving,

protecting and preserving stream and river water quality. Application has been made to VADCR for funding to support a program manager. Currently in the early planning phase, the program will focus on tax incentives, development proffers and the proposed VADEQ nutrient trading program to fund easement purchases. Agencies/groups involved include: Fauquier County Dept. of Community Development, Fauquier County Agricultural Development Office, Fauquier County Administration, Fauquier County Health Department, Fauquier County GIS Department, Virginia Department of Conservation and Recreation, VADEQ, Virginia Dept. of Forestry, Occoquan Watershed Monitoring Laboratory, Rappahannock River Basin Commission, RRRC, Northern Virginia Regional Commission, Virginia Outdoors Foundation, Piedmont Environmental Council, Goose Creek Association, Friends of the Rappahannock, and Citizens for Fauquier County.

Fauquier County Water Resources Management Plan

Although focused primarily on groundwater, the plan, currently in its development phase, will evaluate all existing water supplies, demand projections, surface water data and resource management issues related to both ground and surface water. Background work for the management plan began in March 2005 as an initiative of the Fauquier County Water Resource Management Program, which coordinates local and regional surface and groundwater issues and initiatives, collects, reviews and analyzes information to guide land development decisions, and coordinates local water resource protection programs.

POTENTIAL FUNDING SOURCES

Potential funding sources available during implementation were identified during plan development. It was noted that Great Run is designated as potential spawning habitat for Blue Back Herring and could be eligible for additional funding from U.S. Fish and Wildlife Service or VDGIF. Detailed description of each source (i.e., eligibility requirements, specifications, incentive payments) can be obtained from the JMSWCD, TCCSWCD, VADCR, NRCS, VCE, and VADEQ. Sources include:

- Virginia Agricultural Best Management Practices Cost-Share Program
- Virginia Agricultural Best Management Practices Tax Credit Program
- Virginia Water Quality Improvement Fund
- Virginia Small Business Environmental Compliance Assistance Fund
- Virginia Revolving Loan Programs
- Community Development Block Grant Program
- Federal Clean Water Act Section 319 Increment Funds
- USDA Conservation Reserve Enhancement Program (CREP)
- USDA Conservation Reserve Program (CRP)
- USDA Environmental Quality Incentives Program (EQIP)
- Wetland Reserve Program (WRP)
- Wildlife Habitat Incentive Program (WHIP)
- U.S. Fish and Wildlife Service Private Stewardship Program
- U.S. Fish and Wildlife Service Conservation Grants

- Southeast Rural Community Assistance Project (Southeast RCAP)
- Chesapeake Bay Small Watershed Grants Program
- National Fish and Wildlife Foundation

A possible funding scenario for BMP installation in the first year of implementation is presented in Table 8. This scenario represents 10% installation of livestock exclusion systems, 10% of pasture management BMPs installed, 10% of cropland converted to vegetated buffers, 10% of cropland manure incorporated into soil, 20% of straight pipes replaced, and 20% of failed septic systems fixed. The scenario does not account for agricultural or residential technical assistance.

Table 8. Possible installation funding scenario for first year of implementation.

TMDL Incentive Funds	
Agricultural Practices	637,500
Residential Practices	160,500
Subtotal	798,000
Landowner	
Agricultural Practices	212,500
Residential Practices	160,500
Subtotal	373,000
Total	**1,171,000**

LIST OF ACRONYMS

AWG	Agricultural Working Group
BMP	Best Management Practice
CCU	Confined Canine Unit
CREP	Conservation Reserve and Enhancement Program
CRP	Conservation Reserve Program
CWA	Clean Water Act
ECI	Engineering Concepts, Inc.
EQIP	Environmental Quality Incentive Program
FTE	Full Time Equivalent
GWG	Governmental Working Group
IP	Implementation Plan
JMSWCD	John Marshall Soil and Water Conservation District
NPS	Nonpoint Source
NRCS	Natural Resources Conservation Service
OSSDS	On-Site Sewage Disposal System
RB-1	Septic System Pump-Out
RB-2	Connection of Malfunctioning OSSDS or Straight Pipe to Public Sewer
RB-3	Septic Tank System Repair
RB-4	Septic Tank Installation / Replacement
RB-5	Alternative On-Site Waste Treatment System
RCAP	Rural Community Assistance Program
RRRC	Rappahannock-Rapidan Regional Commission
RWG	Residential Working Group
SL-6	Grazing Land Protection System
TCCSWCD	Tri-County City Soil and Water Conservation District
TMDL	Total Maximum Daily Load
USEPA	Environmental Protection Agency
VADCR	Virginia Department of Conservation and Recreation
VADEQ	Virginia Department of Environmental Quality
VCE	Virginia Cooperative Extension
VDACS	Virginia Department of Agriculture and Consumer Services
VDGIF	Virginia Department of Game and Inland Fisheries
VDH	Virginia Department of Health
WQMIRA	Water Quality Monitoring, Information and Restoration Act
WHIP	Wildlife Habitat Incentive Program
WRP	Wetland Reserve Program

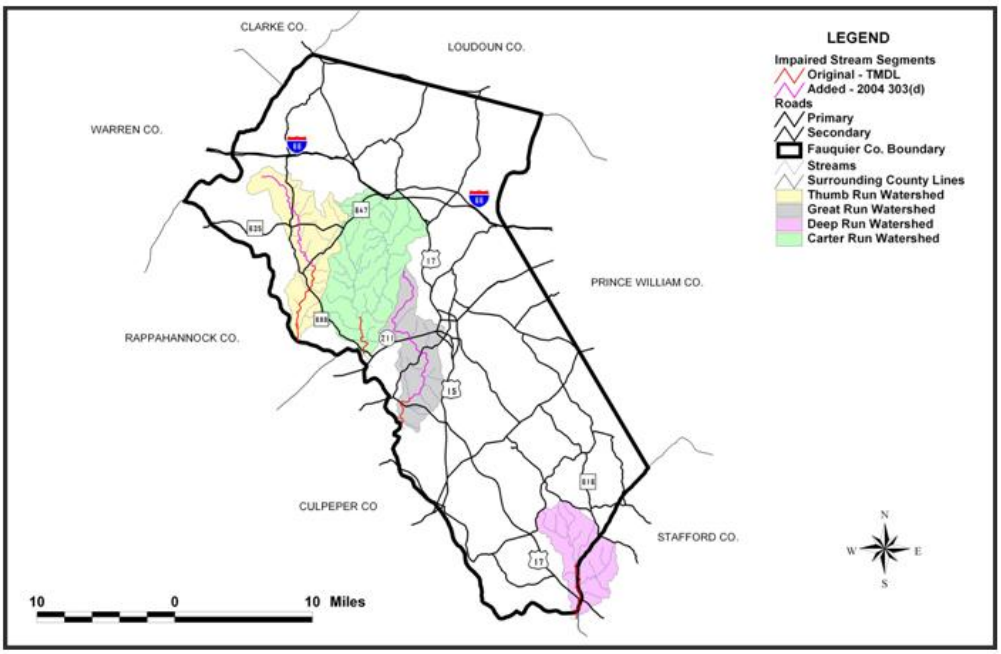
CARTER, GREAT, THUMB, & DEEP RUNS
TMDL IMPLEMENTATION PLAN DEVELOPMENT

FINAL PUBLIC MEETING
April 4, 2006

PROJECT BACKGROUND

- Streams placed on Commonwealth of Virginia's Section 303(d) List of Impaired Waters for over 10.5% violation rate of the bacteria water quality (WQ) standard
  - Deep Run - initially listed in 1996
  - Thumb Run, Carter Run, Great Run – initially listed in 1998
- Total Maximum Daily Load (TMDL) studies determining maximum amount of bacteria the streams can assimilate without surpassing WQ standard completed
  - Thumb Run – approved by USEPA in May 2002
  - Carter Run – approved by USEPA in March 2005
  - Great Run – approved by USEPA in March 2005
  - Deep Run – approved by USEPA in May 2004

STUDY AREA



IMPLEMENTATION PLAN OUTLINE

I. Review of TMDL Development Studies
II. Public Participation
III. Implementation Actions
IV. Measurable Goals & Milestones
V. Stakeholders' Roles & Responsibilities
VI. Potential Funding Sources

REVIEW OF TMDL DEVELOPMENT STUDIES

Agricultural

- Most/all livestock excluded from streams
- Reductions in bacteria runoff loads from pasture and cropland in Carter Run, Great Run, & Deep Run

Residential

- All straight pipes & failing septic systems identified & corrected
- Pet bacteria loads on residential land use reduced in Carter Run, Great Run, & Deep Run

Wildlife

- Wildlife bacteria loads reduced in Carter Run & Great Run

REVIEW OF TMDL DEVELOPMENT STUDIES

- TMDL IP focuses on livestock and human reductions
- Wildlife reductions addressed through:
  - VDGIF management recommendations for landowners
  - Education
  - Use attainability analysis / secondary contact designated use

PUBLIC PARTICIPATION

- Public meetings
- Steering committee
- Working groups
  - Agricultural
  - Residential
  - Governmental

- Summary
  - BMP types
  - Education & technical assistance
  - Monitoring
  - Funding

IMPLEMENTATION ACTIONS

- Identify and quantify actions for Stages I & II of implementation
  - Spatial analysis
  - VADCR Agricultural BMP Database analysis
  - TMDL development documents
  - Input form AWG, RWG, GWG, & steering committee

TWO-STAGED IMPLEMENTATION

- Stage I
  - Implementation goal to attain bacteria water quality standard enabling delisting of streams from Section 303(d) List of Impaired Waters
- Stage II
  - Implementation goal to attain TMDL source load allocations
  - Must be included in implementation plan
    - Required under WQMIRA
    - Required by USEPA for funding eligibility

IMPLEMENTATION ACTIONS

- Identify types and quantify technical assistance needed to implement actions for Stages I & II of implementation
  - VADCR Agricultural BMP Database analysis
  - Input from JMSWCD, RWG, GWG, & steering committee
- Technical assistance / education provided through
  - JMSWCD & TCCSWCD lead for agricultural BMPs
  - VDH lead for on-site sewage disposal systems
  - VCE will promote education & outreach for pet waste reductions
- Determine associated cost and benefits of actions for Stages I & II of implementation
  - Implementation action multiplied by average unit cost

IMPLEMENTATION ACTIONS

Agricultural Needs

Control Measure	Unit	Stage I Units Needed	Stage II Units Needed	Unit Cost ($)
Livestock Exclusion System	system	167	0	20,000
Pasture Management System	acre[1]	16,270	0	200
Vegetative Buffer on Cropland	acre[1]	3,200	0	560
Manure / Biosolids Incorporation on Cropland	acre[1]	5,330	0	20
Retention Pond	acre[2]	0	16,270	2,000
Technical Assistance	FTE	10	10	60,000
Administrative Assistance	FTE	5	5	45,000

[1] Acres installed, [2] Acres treated

IMPLEMENTATION ACTIONS

Stream Exclusion for Cattle

Vegetated Buffers

Pasture Management System

IMPLEMENTATION ACTIONS

Retention Ponds

IMPLEMENTATION ACTIONS

Residential Needs

Control Measure	Unit	Stage I Units Needed	Stage II Units Needed	Unit Cost ($)
Alternative Sewage Disposal System	system	44	0	25,000
New Septic System	system	146	0	7,000
Repaired Septic System	system	102	0	3,500
Pet Waste Control Program	system	3	0	3,750
Concentrated Canine Unit Demonstration Project	system	2	0	20,000
Concentrated Canine Unit Treatment System	system	25	0	5,000
Landscape BMP Demonstration Project	system	2	0	20,000
Retention Pond	$acre^2$	0	797	2,000
Infiltration Trench	$acre^2$	0	265	9,000
Rain Garden	$acre^2$	0	265	12,000
Technical Assistance	FTE	7.5	7.5	60,000
Administrative Assistance	FTE	4	4	45,000

IMPLEMENTATION ACTIONS

Conventional Septic System

Alternative Sewage Disposal System
(Secondary Treatment with Drip Irrigation)

Pet Waste Disposal Station

IMPLEMENTATION ACTIONS

Rain Gardens

Infiltration Trenches

IMPLEMENTATION ACTIONS

Total Cost (million $)

	Stage I	Stage II
Livestock Exclusion	3.34	0.00
Pasture Loads	3.25	32.54
Cropland Loads	1.90	0.00
On-site Sewage Disposal Systems	2.48	0.00
Pet Waste	0.22	7.17
Agricultural Technical Assistance	0.83	0.83
Residential Technical Assistance	0.62	0.21
Total	***12.64***	***40.75***

IMPLEMENTATION ACTIONS

Benefits

- Water quality
  - Human health
  - Environmental
    - Bacteria, nutrient, & sediment loads to streams reduced
    - Aquatic community improved
  - Integration with other WQ efforts
    - Chesapeake Bay Nutrient and Sediment Reduction Strategy for the Rappahannock River Basin
    - Riparian Easement Program
    - Water Resources Management Plan
- Economic
  - Agricultural producers
  - Homeowners
  - Local economy & community

MEASUREABLE GOALS AND MILESTONES

- End goals
  - Restored water quality in impaired streams
  - Stage I: De-listing of streams from Section 303(d) List of Impaired Waters
  - Stage II: meet specified TMDL goal
- Milestones
  - Implementation
  - Water quality
- Evaluate progress
  - BMP tracking
  - Water quality monitoring

MEASUREABLE GOALS AND MILESTONES

Milestone	Stage	Date	Implementation Milestones							
			Livestock Exclusion Systems	Pasture Management System BMPs	Cropland Land-Applied BMPs	Retention Ponds	Straight Pipes	Failing Septic Systems	Stage I Pet Waste BMPs	Stage II Pet Waste BMPs
			(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
0		6/1/06	Implementation Begins							
1	I	6/1/07	0	10	10	---	20	20	20	---
2		6/1/08	0	30	30	---	40	40	40	---
3		6/1/09	0	50	50	---	60	60	60	---
4		6/1/10	0	80	80	---	80	80	80	---
5		6/1/11	0	100	100	---	100	100	100	---
6		12/1/11	De-listing from Section 303(d) List of Impaired Waters							
7	II	6/1/12	---	---	---	24	---	---	---	20
8		6/1/13	---	---	---	48	---	---	---	40
9		6/1/14	---	---	---	74	---	---	---	60
10		6/1/15	---	---	---	100	---	---	---	100
11		6/1/16	TMDL Load Allocations Attained							

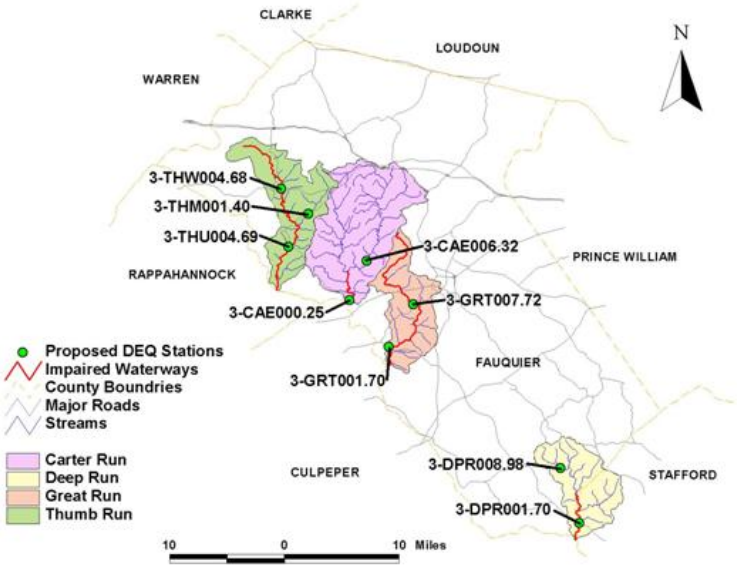
MEASUREABLE GOALS AND MILESTONES

Milestone	Stage	Date	Water Quality Milestone			
			Instantaneous Water Quality Standard Exceedances in:			
			Carter Run	Great Run	Thumb Run	Deep Run
			(%)	(%)	(%)	(%)
0		6/1/06	34	35	35	35
1	I	6/1/07	30	31	32	35
2		6/1/08	20	25	28	33
3		6/1/09	16	22	23	29
4		6/1/10	10	11	14	21
5		6/1/11	10	11	8	12
6		12/1/11	De-listing from Section 303(d) List of Impaired Waters			
7	II	6/1/12	8	7	0	8
8		6/1/13	4	5	0	4
9		6/1/14	4	5	0	0.2
10		6/1/15	0	0	0	0
11		6/1/16	TMDL Load Allocations Attained			

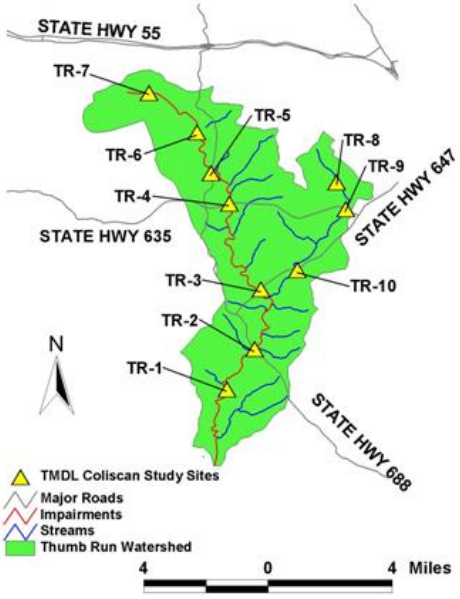
MEASUREABLE GOALS AND MILESTONES

- BMP tracking
  - John Marshall SWCD & Tri-County City SWCD
  - Virginia Department of Health
  - Fauquier County
- Water quality monitoring
  - VADEQ
    - Nine stations sampled bi-monthly in four impairments
    - Commitment to monitor at 3-DPR001.70 indefinitely
    - Commitment for remaining stations from 01/06 through 12/07
  - John Marshall SWCD
    - *E. coli* coliscan for 10 stations in Thumb Run

MEASUREABLE GOALS AND MILESTONES



MEASUREABLE GOALS AND MILESTONES



STAKEHOLDERS' ROLES & RESPONSIBILITIES

- Participation
  - Fauquier and Stafford County residents
  - John Marshall SWCD and Tri-County City SWCD
  - Fauquier and Stafford County governments
  - Rappahannock-Rapidan Regional Commission
  - Virginia Department of Health
  - Virginia Department of Environmental Quality
  - Virginia Department of Conservation and Recreation
  - Virginia Department of Agricultural & Consumer Affairs
  - Virginia Cooperative Extension
  - Virginia Department of Game and Inland Fisheries
  - USDA - Natural Resources Conservation Service
  - United States Environmental Protection Agency

POTENTIAL FUNDING SOURCES

- FEDERAL
  - Federal Clean Water Act Section 319 Increment Funds
  - USDA Conservation Reserve Program (CRP)
  - USDA Conservation Reserve Enhancement Program (CREP)
  - USDA Environmental Quality Incentives Program (EQIP)
  - USDA Wildlife Habitat Incentive Program (WHIP)
  - USDA Wetland Reserve Program (WRP)
  - U.S. Fish and Wildlife Service Private Stewardship Program
  - U.S. Fish and Wildlife Service Conservation Grants

POTENTIAL FUNDING SOURCES

- STATE
  - VA Agricultural BMP Cost-share Program
  - VA Agricultural BMP Tax Credit Program
  - VA Water Quality Improvement Fund
  - VA Small Business Environmental Compliance Assistance Fund
  - VA Revolving Loan Programs
  - Community Development Block Grant Program
- LOCAL OR REGIONAL
  - Southeast Rural Community Assistance Project (Southeast RCAP)
  - Chesapeake Bay Small Watershed Grants Program
- PRIVATE FOUNDATIONS
  - National Fish and Wildlife Foundation
- LANDOWNER CONTRIBUTIONS / MATCHING FUNDS
  - Cost-share match to state and federal programs

POTENTIAL FUNDING SOURCES

Example Scenario 1

✓ Livestock exclusion system

✓ Participation in VA Agricultural Cost-share Program

Cost / Credit	$
System cost	20,000
75% Cost-share	-15,000
25% Tax Credit	-1,250
Cost to Landowner	***3,750***

POTENTIAL FUNDING SOURCES

Example Scenario 2

- ✓ Livestock exclusion system
- ✓ If regulatory authority or court action forces participation

Cost / Credit	$
System cost	20,000
0% Cost-share	-0
0% Tax Credit	-0
Cost to Landowner	***20,000***

POTENTIAL FUNDING SOURCES

Example Scenario 3

- ✓ Alternative sewage disposal system
- ✓ Household with moderate income 60-80% of county median income
- ✓ Participation in VA Cost-share Program

Cost / Credit	$
System cost	25,000
60% Cost-share	-15,000
Cost to Landowner	***10,000***

POTENTIAL FUNDING SOURCES

Example Scenario 4

- ✓ Alternative waste treatment system
- ✓ Household with moderate income 60-80% of county median income
- ✓ If regulatory authority or court action forces participation

Cost / Credit	$
System cost	25,000
0% Cost-share	-0
Cost to Landowner	***25,000***

NEXT STEPS

- 30-day comment period
- USEPA approval of implementation plan
- VADCR to issue grant agreements with JMSWCD, VDH, and VCE to provide technical assistance and cost-share funding
- Cost-share funds available now – contact local agency representative

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- Jeff Walker, Rappahannock-Rapidan Regional Commission
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Virginia Department of Health - Environmental Health
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